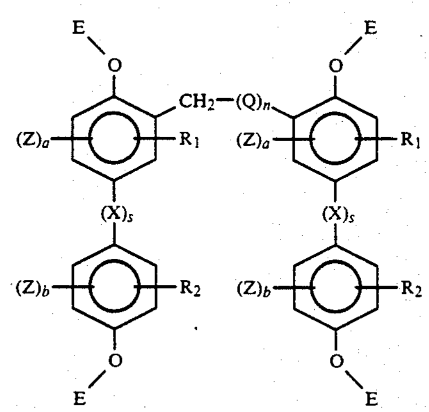
In a preferred embodiment, E is at least 70% vinyl benzyl and the remaining E's are propyl.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Polymeric Resins

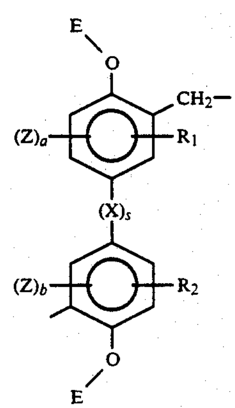
In U.S. Pat. No. 4,855,375, one of the present inventors disclosed the preparation and use of the ethers of the oligomeric condensation products of a dihydric phenol and formaldehyde and their use in composites, especially laminated boards for electronic uses. It has now been found that these compositions can be used as interlevel dielectrics, where they have the advantages of low water absorption, low dielectric constant, low coefficient of thermal expansion, high glass transition temperature, high thermal stability, high solids coating concentrations, and are photochemically curable, thermally curable, and generate little or no volatiles during the curing process.

The prepolymers used in forming a pattern have the formula



They result from the etherification of oligomers which are the condensation product of a dihydric phenol and formaldehyde. The product will be a mixture of oligomers with varying molecular weight. The number, n, of recurring units Q generally will vary from 1 to 10. Preferably, n is 1 or an integer from 1 to 6 and the number average of n is about 3.

The recurring unit Q itself has the structure,



OR

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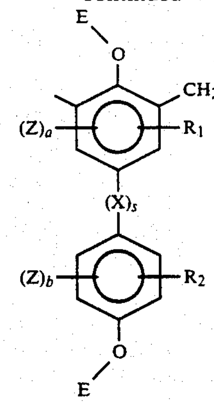
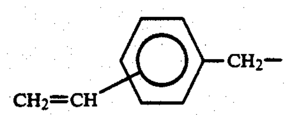


Note that the condensation may occur either on the same ring, as in the right hand structure, or in different rings, as in the left hand structure. The aromatic rings in the recurring unit Q are separated by an intervening moiety X. That is, S is 1. Each of the moieties X is hexafluoroisopropylidene $[C(CF_3)_2]$.

Each of the aromatic rings may bear substituents or may be completely unsubstituted. Thus, R_1 and R_2 are independently selected from moieties such as hydrogen, alkyl moieties containing from 1 to 10 carbon atoms, the phenyl moiety, alkoxy moieties containing from 1 to 10 carbon atoms, and phenoxy, C_6H_5O. Examples of suitable alkyl moieties include methyl, ethyl, propyl, butyl, pentyl, hexyl, heptl, octyl, nonyl, and decyl moieties. The methyl and tertbutyl butyl groups are preferred alkyl moieties, although the variant where $R_1=R_2=H$ is quite desirable.

The basic resins can be modified to be flame retardant by incorporating halogen atoms into the aromatic rings. Thus, Z may be a halogen atom, especially bromine, and where the aromatic ring is halogenated a and b are integers from 1 to 4. Polyhalogenated materials are preferred as flame retardants, and thus a and b are recommended to be 2, 3, or 4.

The oligomeric condensation products have a multiplicity of phenolic hydroxyl groups substantially all of which are end-capped as ether groups in our interlevel dielectric resins. The best case results where the ether portion, E, is a vinylbenzyl moiety, that is, of the structure.



which may be either the meta- or para-isomer, and which usually is a mixture of the meta- and para-isomers. Although it is desirable to have all the phenolic hydroxyls end-capped with vinylbenzyl moieties, there is a cost advantage when fewer than all of the ether groups are vinylbenzyl, but usually at the expense of a somewhat lower dielectric constant. At least 50% of the E moieties should be a vinylbenzyl moiety, but better performance characteristics result when from 70 to 100% of the ether groups are vinylbenzyl, and the best prepolymer product results when 95 to 100% of such groups are vinylbenzyl. However, for many applications less than complete end-capping with vinyl benzyl